

## CLAIMS

What is claimed:

1. A method of depositing a film on a substrate in a reaction chamber, comprising:

5 introducing a first gas into the reaction chamber;  
initiating a first pulse of electromagnetic irradiation to form radicals species from said first gas, where the radical species react with the surface of the substrate to form a radical terminated surface on the substrate;

10 purging the reaction chamber;  
introducing a second gas into the reactor; and  
initiating a second pulse of electromagnetic irradiation to form second radicals species from said second gas, where the second radical species react with the radical terminated surface to form a layer of film on the substrate.

15 2. A method of removing a film on a substrate in a reaction chamber, comprising:  
introducing a gas into the reaction chamber;  
irradiating the gas with a first pulse of electromagnetic irradiation, forming radical species from said gas; and

20 reacting the radicals with the film on the surface of the substrate to form a volatile compound and thus removing an atomic layer of the film.

3. A method for depositing an atomic layer on a substrate in a reaction chamber comprising:

introducing reactant gas or gasses into the reaction chamber and reacting the reactant with the surface of the substrate to form an atomic layer on the surface of the substrate;

25 evacuating the reaction chamber; and  
irradiating the surface of the substrate with ultra-violet radiation.

4. The method of claims 1, 2 or 3 further comprising:  
pre-treating the substrate to condition the surface of the substrate.

5. The method of claims 1, 2 or 3 wherein said purging step comprises  
30 evacuating the reaction chamber, purging with an inert gas, or both.

6. The method of claim 1 further comprising:  
purging the chamber after the step of initiating a second pulse of electromagnetic irradiation; and  
repeating the steps to form a desired film.

7. The method of claims 1 or 2 wherein the method is carried out at a temperature in the range of approximately 20 to 400 °C.

8. The method of claims 1 or 2 wherein the method is carried out at a temperature in the range of approximately 100 to 200 °C.

5 9. The method of claims 1, 2 or 3 wherein the method is carried out at a temperature in the range of approximately 20 to 30 °C.

10. The method of claims 1 or 2 wherein the electromagnetic irradiation is comprised of visible light radiation, infrared radiation, ultraviolet radiation, microwave radiation, radio frequency radiation or vacuum ultraviolet radiation.

10 11. The method of claims 1 or 2 wherein the introducing and initiating steps are carried out at a pressure in the range of approximately 1mTorr to 760 Torr.

12. The method of claims 1 or 2 wherein the introducing and initiating steps are carried out at a pressure in the range of less than approximately 150 Torr.

15 13. The method of claims 1 or 2 wherein the introducing and initiating steps are carried out at a pressure in the range of less than approximately 15 Torr.

14. The method of claim 3 wherein the method is carried out in a vacuum and at a temperature in the range of approximately 20 to 30 °C.

20 15. The method of claim 3 further comprising  
purging the chamber following the irradiating step and,  
repeating the steps a plurality of times with the same or different reactant gasses.